

Contribution to the butterfly fauna of Yunnan, China (Hesperioidea, Papilionoidea)

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Abstract. The results of a lepidopterological (Hesperioidea, Papilionoidea) expedition to Yunnan, China in 2006 are presented. In Appendix I all butterfly and skipper species observed during the expedition are recorded in an increasing altitudinal gradient separated into four altitudinal classes, from 760 m to 3000 m. Some taxa mentioned in Appendix I are reviewed for reasons of taxonomy, distribution, or scarcity. The change in species composition from low to high altitude and the biogeography of some taxa with both Oriental and Palaearctic distributions are discussed. The faunal similarity between the different altitudinal classes was calculated and the interface between the Oriental and Palaearctic faunas in relation to latitude is briefly discussed. *Clossiana gong xizangensis* Huang, 2000, syn. n. is synonymized with *Clossiana gong charis* (Oberthür, 1891).

Introduction

Our knowledge of the butterfly (including HesperIIDae) fauna of Yunnan (the southwest of the People's Republic of China) has increased in the last 10 years and many faunistic and taxonomic publications on the butterflies and skippers of this part of China are now available: Bozano (1999), Chou (1994), Della Bruna et al. (2002, 2004), Huang (2001, 2003), Huang & Wu (2003), Huang & Xue (2004), Tuzov & Bozano (2006), and Weidenhoffer et al. (2004). These workers have compiled a lot of data on the butterfly fauna of Yunnan, but much information remains to be gathered. In 2006 we had the opportunity to organize an entomological expedition to Yunnan to obtain additional evidence into the species composition, biogeography, and altitudinal succession of the butterflies in the transition zone between the Palaearctic and the Oriental regions. In addition, we were interested to obtain more faunistic data on lesser-known taxa in genera *Aporia* Hübner (Pieridae) and *Callerebia* Butler and *Lethe* Hübner (Nymphalinae). Our choice to visit Yunnan was motivated by its geographical position because in the south it borders on Vietnam, Laos, and Myanmar (previously called Burma) (Fig. 1). Southern Yunnan is mainly tropical and belongs to the Oriental biogeographical realm. In the north the climate becomes moderate and the fauna gradually changes from Oriental to Palaearctic. The gradient from south to north is from low (760 m) to high altitude (3000 m). These transitions are considered to be most interesting because the highest species diversity can be expected along this gradient.

Material and Methods

All butterfly species mentioned here were collected between June 15 and July 5, 2006. No bait or pheromones were used. In the species lists (Appendices I and II) the visited localities are arranged in altitudinal order 760 m, 1700–2000 m, 2200–2400 m, and 2600–3000 m. The species are arranged in alphabetical order by family-group taxon

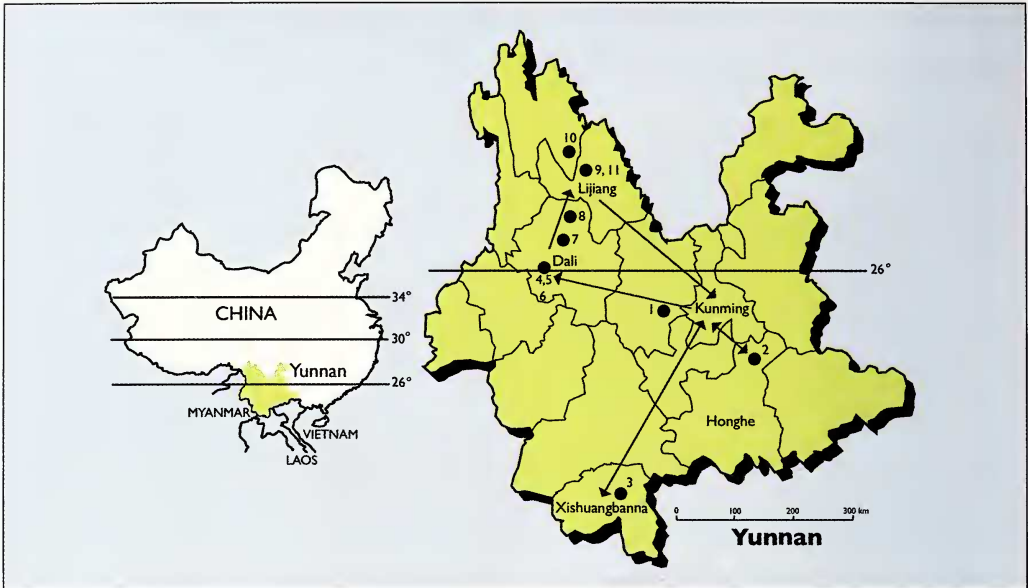


Fig. 1. Map of China and Yunnan; the black dots indicate our collecting localities.

to allow for a quick search. To the localities the mean collecting time is added in days or hours (pers. obs.). One collecting day refers to about 6 hours. Along the altitudinal gradient the effective collecting efforts were: 2.5 days (760 m), 2 days (1700–2000 m), 6.5 days (2200–2400 m), and 3.5 days (2600–3000 m). For the nomenclature we followed Bozano (1999), Della Bruna et al. (2002, 2004), Eliot & Kawazoé (1983), Huang (2001, 2003), Huang & Wu (2003), Huang & Xue (2004), Tuzov & Bozano (2006), Weidenhoffer et al. (2004), and for the Pieridae we also consulted the web site of Ziegler (2005). For general information the web site of Markku Savela (1999) was of great help. But we respected Mr Savela's view, indicated on his web site, of not using it as a taxonomic reference. For some species in genera like *Delias* Hübner, *Mycalesis* Hübner, *Ypthima* Hübner, and *Lycaenopsis* C. & R. Felder, the male genitalia were dissected. In *Satyrrium* Scudder some female genitalia were also dissected.

De Jong (1976) calculated a similarity coefficient between the butterfly faunas of the West Palearctic and Ethiopian regions according to the following formula:

FS = $(a,b) / a + b - (a,b)$, where: FS = faunal similarity

a = number of taxa restricted to region A

b = number of taxa restricted to region B

(a,b) = number of taxa common to A and B

This formula allows a quick comparison of resemblances between pairs of regions, though it may be less convenient for further statistical processing. A high coefficient indicates a highly similar faunas. A coefficient below 0.5 indicates hardly any similarity at all. We used this formula with our observations and compared the different altitude classes (see Table 3).

Collecting localities

1. The Western Hills (Xishan), 30 km west of Kunming, 2200 m, 16 and 18 June 2006 (N 24.56.896, E 107.37.717). Mainly a forested park with flourishing trees and undergrowth. It stretches from north to south for about 40 km. Collecting time: 2 days.
2. Shilin, Stone Forest Reserve, 100 km southeast of Kunming, 1700 m, 17 June 2006 (N 24.49.111, E 103.19.649). This is actually a world of stone peaks, stalagmites, subterranean rivers, and underground limestone caves. This typical karst physiognomy takes the form of a forest of stone pillars and boulders. Between these pillars we found open vegetation and small bushes. Collecting time: 1 day. (Fig. 2)
3. Jinghong, Xishuangbanna, Sanchahe Nature Reserve, 48 km north of Jinghong, 760 m, 19–21 June 2006 (N 22.10.489, E 100.50.591). This Nature Reserve is a huge, mainly primary tropical rainforest. We visited the Wild Elephant Valley (Yexang-gu) situated at the border of the western and eastern parts of the Menyang Reserve. Collecting time: 2.5 days.
4. Dali, 10 km southwest, 2200 m, 25–27 June 2006 (N 25.39.030, E 100.10.038). Located at the foot of the Cangshan Mountains. Surroundings of the starting point of the cable-lift (see also loc. 5) were explored. The area is a mix of tea plantations with open vegetation, bushes, and forests of mainly coniferous trees. Collecting time: 2 days. (Fig. 3)
5. Dali, 10 km southwest, 2600 m, 26–27 June 2006 (N 25.28.025, E 100.08.753) at the end of the cable-lift. Mainly a coniferous forest. Collecting time: 1 day.
6. Dali, 10 km west, 2200 m, 27 June 2006, at the starting point of another chair-lift. The area has an open varied vegetation, bushes and trees, more or less disturbed by human influence. Collecting time: 1 day.
7. Butterfly Spring Valley, 30 km north of Dali, 2030 m, 28 June 2006 (N 25.50.624, E 100.05.856). A public park with a butterfly farm. Collecting time: 1 day.
8. Road Dali-Lijiang, 120 km south of Lijiang, a short stop on 29 June 2006, 2200 m (N 25.59.045, E 100.06.989). Open disturbed area. Collecting time: 1 hour.
9. Lijiang City, Black Dragon Pool Park, 2400 m, 30 June 2006 (N 26.49.940, E 100.14.062). A varied public park with ponds and many flowers along paths. Collecting time: 1 day.
10. Jade Dragon Snow Mountain (Yulongxueshan), 45 km north of Lijiang City, 3000 m, 1–3 July 2006 (N 27.03.828, E 100.14.588). A natural mountain area with alpine shrub and meadows between scattered areas of coniferous trees, near a Mountain Service Centre. Collecting time: 2.5 days.
11. Lijiang City, Black Dragon Draper Pool Park, 2400 m, 2 July 2006. A varied public park with small lakes and many flowers. Collecting time: 0.5 day.



Figs 2–3. 2. Stone Forest Reserve, 1700 m, Shilin, Yunnan, with typical karst formation. 3. Collecting area at locality 4 with tea plantations and open vegetation, bushes and forest of mainly coniferous trees. Photos by R. Vis.

Results

Species of interest

Some taxa, mentioned in Appendix I are reviewed here for reasons of taxonomy, distribution, or scarcity. The treatment of the species usually follows the arrangement adopted in the Guide to the butterflies of the Palearctic region (Bozano 1999; et seq.). The distribution is given for the relevant subspecies only.

Hesperiidae

Halpe hauxwelli Evans, 1937

Type locality: Thoungyin Valley, Assam, India

Distribution: Thailand, Myanmar, and S Yunnan, China

Notes: Huang et al. (2003: 136) recorded the species for the first time for the Chinese fauna based on a specimen collected in 1957 by Wang Shu-Yong in Xishuangbanna, S Yunnan. The species was also mentioned from that area in 2003 (Huang & Xue 2004). *Halpe hauxwelli* belongs to the Oriental fauna and seems to be restricted to forests with tropical characteristics. Up until now no records are known from other places in Yunnan. We found some specimens of this local and rare skipper at locality 3.

Potanthus ganda Fruhstorfer, 1911

Type locality: Nias, Sumatra, Indonesia

Distribution: N E India (Assam), Vietnam, Thailand, China (Yunnan, Guangxi, Hainan), up to Indonesia (Bali)

Notes: The male genitalia of the specimens we collected were examined by Dr de Jong. According to Corbet & Pendlebury (1956) *P. ganda ganda* is a common Malayan species. Unlike the closely related *P. omaha* Edwards, *P. ganda* ascends hills and is con-

fined to primary forest. Huang (2004) reports the species from Ye-xiang-gu. We found some specimens in the same area (locality 3).

Pieridae

Aporia bieti (Oberthür, 1884)

Type locality: Kangding (Tatsienlu), Sichuan, China

Subspecies: *Aporia bieti gregoryi* Watkins, 1927

Type locality: N of Dali, W Yunnan, 2700–3300 m, China.

Distribution: China, N Yunnan (Lijiang, Zhongdian)

Note: In Yunnan we found this species in very low numbers only in a park of Lijiang city (locality 11).

Aporia martinetti (Oberthür, 1884)

(Fig. 4)

Type locality: Kangding (Tatsienlu), Sichuan, China

Distribution: China (Sichuan, Yunnan)

Notes: The taxonomic status of this taxon is somewhat unclear since Röber in Seitz (1909) supposed *martinetti* to belong to the taxon *bieti*. Ziegler (2005) as well as Della Bruna et al. (2004) treat *martinetti* as a separate species based on differences of the habitus and genitalia. We can confirm these opinions. Especially the heavily venation (see also d'Abbrera (1990: 77) of the underside of the hindwings is a constant character. We found *martinetti* uncommonly in bushy meadows at locality 10.

Anthocharis bieti (Oberthür, 1884)

Type locality: Kangding (Tatsienlu), W China

Distribution: China (including Tibet)

Variation: According to Ziegler (2005) the following subspecies are found in China:

ssp. *bieti* (Oberthür, 1884); Distribution: W China

ssp. *decorata* (Röber, 1907); Type locality: Kukunor, China

ssp. *detersa* (Verity, 1908); Type locality: Amdo, China

ssp. *mandschurica* (Bollow, 1930); Type locality: Manchuria, China

Notes: Hirschfeld & Back (2001) recorded *bieti* in Tibet until 4400 m. Huang (2001, 2003) does not report the species from NW Yunnan and SE Tibet. At locality 10 a male and a female of this local and rare butterfly were found, together with *Aporia martinetti* Oberthür, *Melitaea bellona* Leech, and *Caerulea coelestis* Alpheraky. Our specimens most likely belong to the nominotypical ssp. *bieti* and match very well the pictures given by Ziegler (2005).

Gonepteryx amintha (Blanchard, 1871)

Type locality: Baoxing (Mou-Pin), Sichuan, China

Subspecies: *murayamae* Nekrutenko, 1973

Type locality: Weihsi, Sichuan, China

Distribution: China (Sichuan, Yunnan)

Notes: At locality 2 several specimens were observed visiting flowers of *Buddleia* bushes. Some *amintha* were also seen in the Western Hills (locality 1).

***Delias subnubila* Leech, 1893**

(Figs 5a, 5b)

Type locality: Baoxing (Mou-Pin)-Bazifang (Pu-tsu-fong), Sichuan, China

Distribution: China (Sichuan, SE Tibet, Yunnan)

Note: According to Della Bruna et al. (2004), an examination of the male genitalia (uncus) is needed to allow for the correct determination of the species because of confusion with the sympatric *Delias sanaca* (Moore, 1858) and *Delias berinda* (Moore, 1872). We dissected the genitalia and our single male turned out to be a real *subnubila*. It was taken at locality 10.

Lycaenidae

***Heliophorus eventa* (Fruhstorfer, 1918)**

Type locality: W China

Distribution: China (S Gansu, W Sichuan, N Yunnan)

Notes: Among the various subspecies known from Yunnan (Huang 1999, 2001, 2003), d'Abrera (1993), Wang & Fan (2002) we only recorded *eventa*.

Males show dark brown forewing uppersides with metallic green at the wingbase. Females differ in shape and markings of the marginal band at the underside of the hindwings.

We found males and females of *eventa* on low vegetation along cultivated areas, mostly on *Rubus* shrubs (localities 4–6). There the males have territories where they perch on projecting bush branches at about 1.50 m. They attack other males that pass by. Sometimes they visit flowers of Umbelliferae and Compositae to feed.

***Satyrium persimilis* Riley, 1939**

(Figs 9a, 9b)

Type locality: Yunnan, China

Distribution: China, Yunnan

Notes: Among material of *Satyrium eximia fixseni* Leech, 1893 from locality 6 one female specimen attracted our attention due to its smaller size, different forewing outer margin, i.e. rounded and less pointed at apex. After a dissection of the genitalia and a comparison with the genitalia of three *S. eximia fixseni* we observed conspicuous dif-

Figs 4–12, 14a–15b. Pieridae, Nymphalinae, Lycaenidae, and Satyrinae of Yunnan. 4. *Aporia martinetti* (Oberthür) verso, ♂, near Yulongxue, Shan Jade Dragon Snow Mountain, 3000 m. 5a, 5b. *Delias subnubila* Leech, recto and verso, ♂, same locality. 6a, 6b. *Melitaea bellona* Leech, recto and verso, ♂, same locality. 7a, 7b. *Melitaea bellona* Leech, recto and verso, ♀, same locality. 8a, 8b. *Neptis divisa* Oberthür, recto and verso, ♂, 10 km SW of Dali, 2200 m. 9a, 9b. *Satyrium persimilis* Riley, recto and verso, ♀, 10 km W of Dali, 2200 m. 10a, 10b. *Satyrium eximia fixseni* Leech, recto and verso, ♀, same locality. 11a, 11b. *Caerulea coelestis* (Alphéraky), recto and verso, ♀, same locality as 4. 12. *Caerulea coelestis* (Alphéraky), recto, ♂. Same locality as 4. 14a, 14b. *Phengaris atroguttata* (Oberthür), recto and verso, ♂, same locality as 4. 15a, 15b. *Lethe sidonis* (Hewitson), recto and verso, ♂, 1700m, Shilin, Stone Forest Reserve, 1700 m. Specimens shown at 75% natural size.

ferences of the signa in the bursa copulatrix, i.e. signa with two thorns in *eximia fixseni* and with one thorn in the unknown female under study. Our conclusion is that this female most probably is the first known female of *S. persimilis*. Up until now only the male type specimen seems to be known (Weidenhoffer et al. 2004: 36). This female will be described in a forthcoming paper.

***Satyrium eximia fixseni* Leech, 1893**

(Figs 10a, 10b)

Type locality: Wa-shan [Hanyan, S of Ya'an, W Sichuan], China

Distribution: China (W Sichuan, Central and N Yunnan)

Notes: At localities 4 and 6 some males and one female were collected. Both sexes have a straight forewing outer margin. The female has a large orange postdiscal patch on the forewing and the underside of both wings are more or less the same as in *persimilis* (see Vis & Coene 2008).

***Caerulea coelestis* (Alphéraky, 1897)**

(Figs 11a, 11b, 12)

Type locality: Kham, W Sichuan, China

Subspecies: *dubernardi* (Hemming, 1931)

Type locality: Tsekou, NW Yunnan

Distribution: China (NW Yunnan)

Notes: Schröder (2006) treats genus *Coerulea* Forster, 1938 and makes it clear that the taxa *coeligena* and *coelestis* cannot be separated by the development and number of spots alone. The genitalia of both species are rather similar. A combination of characters as discussed by Schröder (2006) seems more reliable. The male of *C. coelestis* is more brilliant blue, the black border at apex is very narrow, and the black spots on the forewing underside are large, elongated, and bordered by a very narrow white rim. The females are almost uniformly brownish on the wings uppersides with only a weak blue dusting basally. In *coeligena* females the blue is much more extensive. According to the above conclusions d'Abrera (1993: 482) figures both species. Li & Wang (1997: 50) figure the upper and underside of a male as *Caerulea coeligena*, but obviously this must be *C. coelestis*! Taking into account all these references, we conclude that we found a good population of *C. coelestis* at locality 10. Males and females were only seen on a relatively small area with sparse vegetation and bare soil.

***Phengaris atroguttata* (Oberthür, 1876)**

(Figs 14a, 14b)

Type locality: unknown

Subspecies: *juenana* (Forster, 1940)

Type locality: Dali, N Yunnan, China

Distribution: China, NW Yunnan

Notes: According to Seitz (1909) the species should be common and widely distributed in West China. At locality 10 we only found one male specimen. The butterfly is much larger and more blue than the illustrated specimen from Siao Lou in d'Abrera (1993: 486) and in Jiu et al. (1995: 162). Huang (2003) reports one male and two females of *juenana* during his expedition to NW Yunnan in June and July 2002. This result does not suggest an abundant occurrence of the species!



Fig. 13. Habitat of *Caerulea coelestis* with sparse vegetation and areas with bare soil; near Yulongxue Shan, Jade Dragon Snow Mountain, 3000 m. Photo by R. Vis.

Nymphalinae

Charaxes aristogiton C. & R. Felder, 1867

Type locality: Unknown (described from Sikkim, Assam, and Burma [Myanmar])

Distribution: Sikkim, Assam to Myanmar, Thailand, Laos

Notes: Chou (1994) mentions the first record for China. Huang (2001, 2003) and Huang & Xue (2004) do not give information on this taxon at all. We collected one male basking in a sunny spot of a small path along a river at locality 3.

Melitaea bellona Leech, 1892

(Figs 6a, 6b, 7a, 7b)

Type locality: Chou Pin Sa, China

Distribution: W China

Note: Some confusion may arise with the partly sympatric *Melitaea jezebel* Oberthür, 1888, but in *bellona* the orange postdiscal band on the upperside of the hindwing is filled with black dots. Also, the heavy black dots in the discal and postdiscal areas on the forewing upper- and underside are absent in *jezebel*. See also d' Abrera (1992: 303). A small population was found at locality 10.

Clossiana gong (Oberthür, 1884)

Type locality: Kangding (Tatsienlu), Sichuan, China

Subspecies: *charis* (Oberthür, 1891)

Type locality: Yunnan, China

Distribution: China

Notes: According to Tuzov & Bozano (2006) the nominotypical subspecies is distributed in Sichuan, while ssp. *xizangensis* Huang, 2000 is represented in SE Tibet. In a number of specimens found at locality 10 the black basal suffusion of the upperside of the hindwing is less developed than in ssp. *xizangensis* while others show this suffusion as in ssp. *charis*.

We also collected specimens with silvery spots in the median band broader and less elongate than in ssp. *charis* while others have these spots as in ssp. *xizangensis*.

Concerning the ground colour of the uppersides most of our specimens are as in ssp. *xizangensis* as figured by Tuzov & Bozano (2006) while others are like ssp. *charis*.

Thus, the diagnostic characters quoted for ssp. *xizangensis* seem to be within the range of the variability of ssp. *charis*. We examined a large series of specimens and we hereby synonymize *Clossiana gong xizangensis* Huang, 2000, syn. n. with *Clossiana gong charis* (Oberthür, 1891).

At location 10 we found a large population of ssp. *charis* flying along with *Melitaea bellona* and visiting flowering plants. Both males and females were in very fresh condition.

***Neptis divisa* Oberthür, 1908**

(Figs 8a, 8b)

Type locality: Tse-kou, China

Distribution: China, N W Yunnan

Notes: This poorly known species was known only from its holotype (Eliot, 1969) for a long time.

Huang (2003) collected two males at Nidadan and a female at Sijitong. At locality 4 a few specimens were observed and collected. They were flying on a forest side while inspecting bushes along a path between tea plantations. Our specimens (males) are very fresh, suggesting that they had recently emerged. The species is figured in Chou (1994: 550) and d'Abbrera (1993: 357). According to our records the distribution of *divisa* extends to Central Yunnan at altitudes of about 2000 m. The specimen figured here apparently has been attacked by a bird.

Satyrinae

***Lethe confusa* Aurivillius, 1897**

Type locality: India

Distribution: N India, Himalayas, Assam, Myanmar, Thailand, Malaya, China (Hainan, SE Tibet, Yunnan)

Notes: Huang (2003) and Huang & Xue (2004) report *L. confusa* from Lishadi, Nujiang Valley in NW Yunnan and from Wang-tian-shu, S Yunnan. We found some specimens of the nominotypical subspecies at locality 3. For a good picture we refer to Jiu et al. (1995: 115).

***Lethe europa* (Fabricius, 1775)**

Type locality: S India

Subspecies: *gada* Fruhstorfer, 1911

Type locality: Tonkin, Siam [Vietnam]

Distribution: N Vietnam and China (S Yunnan)

Notes: Subspecies *gada* is also known under the name *Lethe nilada f. gada* Fruhstorfer, 1911 from Tonkin, Siam [Vietnam], and even as a valid species as *Lethe gada* Dubois & Vitalis de Salvaza, 1919, from Tonkin. As far as we can interpret now *Lethe europa*

f. gada and *Lethe gada* are synonyms. Huang & Xue (2004) report this species under the name *Lethe europa gada* Fruhstorfer from Ye-xiang-gu in the southern part of the Meng-yang Nature Reserve, S Yunnan. In the same area (locality 3) we collected one specimen, which, in our opinion, also belongs to ssp. *gada*.

***Lethe sidonis* (Hewitson, 1863)**

(Figs 15a, 15b)

Type locality: Darjeeling, India

Distribution: Afghanistan, NW Himalayas to Bhutan, Sikkim, Assam, Myanmar, Vietnam, China (SE Tibet, NW and Central Yunnan).

Notes: Bozano (1999) mentions the distribution of this species only as S Tibet and Himalayas. Huang (2003), who collected 10 specimens during his expedition to Nujiang and Dulongjiang, NW Yunnan, mentioned the species under the genus name *Zophoessa*. We collected two specimens, one at locality 1 and the other at Shilin, locality 2.

***Lethe kansa* (Moore, 1857)**

(Figs 16a, 16b)

Subspecies: *vaga* Fruhstorfer, 1911

Type locality: Tenasserim, Myanmar

Distribution: S Myanmar, S Thailand, China (S Yunnan)

Notes: Talbot (1947) distinguishes *vaga* as a dry-season form and *kansa* as the wet-season form and as a consequence not as a valid subspecies. Huang & Xue (2004) mention the species from Ye-xiang-gu, S Yunnan. At locality 3 we collected two males. Our specimens are much darker than the illustrations of d'Abrera (1984: 419).

***Neope yama* (Moore, 1857)**

(Figs 17a, 17b)

Type locality: Bhutan, N India

Subspecies: *serica* (Leech, 1892)

Type locality: unknown

Distribution: N Vietnam, SW China

Notes: The taxonomic status of ssp. *serica* is unclear as Huang (2003: 96) treats *serica* as a separate species while Chou (1994: 351) reports it as *Neope yama* ssp. *serica*. Lee (1962: 145) described ssp. *kinpingensis* based on one male and one female from Yunnan. Huang (2003: 96) examined the holotype of *kinpingensis* Lee and treated it as synonymous with *serica* Leech, referring to the revision of Sugiyama (1994), but we could not consult the latter publication.

We only collected one male (locality 1) of ssp. *serica* and it matches very well with the figure given by Chou. The butterfly flew leisurely and low above the grass along a forest edge at about 2200 m in cloudy weather conditions.

***Callerebia polyphemus* (Oberthür, 1876)**

Type locality: Moupin (Baoping, W Sichuan) China

Distribution: S-E China, N Myanmar, India (Assam)

Notes: The taxonomic status of this species is still somewhat unclear. In China the following taxa are known according to Della Bruna et al. (2002).

- ssp. *confusa* Watkins, 1925; Type locality: Chang Yang (Yichang, Hubei), China
- ssp. *oberthueri* Watkins, 1925; Type locality: Wa-Shan (near Omei Shan), W Sichuan, China
- ssp. *polyphemus* (Oberthür, 1876); Distribution: Gansu, S Shaanxi, Sichuan, SE Tibet
- ssp. *ricketti* Watkins, 1925; Type locality: Kuatum (Kao-Tien, Fujian), China
- ssp. *suroia* Tytler, 1914; Type locality: Suroj (Manipur, Assam) NE India

Furthermore, a new species, *Callerebia ulfi* Huang, 2003 was described from Dulong Valley, NW Yunnan, based on internal and external characters and differing from *polyphemus*, *confusa*, *ricketti*, and *suroia*. Subspecies *oberthueri* is treated as synonym of ssp. *polyphemus* by Huang.

Huang (2003) in his systematic arrangement classifies *suroia* as a valid species while Della Bruna et al. (2002) consider *suroia* to be a subspecies of *polyphemus*. We follow Della Bruna et al. (2002) in their systematic arrangement of *polyphemus* and allied taxa.

We collected a number of specimens in the area of Dali (localities 4, 5 and 6). A dissection of the male genitalia of one male shows that our material belongs to ssp. *suroia*.

***Loxerebia sylvicola* (Oberthür, 1886)**

(Figs 18a, 18b)

Type locality: Chapa, 2 km S of Luding, W Sichuan, China

Subspecies: *gregory* Watkins, 1927

Type locality: Loma Valley, N Yunnan, China

Distribution: China (N Yunnan)

Notes: This species was present in one of the public parks of Lijiang City (locality 9). It was flying near half-shadowed bushes and near paths. An obvious aberrant specimen (Figs 19a, 19b) with premarginal elongated ocelli on both the upper- and underside of the wings was collected there.

***Loxerebia ypthimoides* (Oberthür, 1891)**

(Figs 20a, 20b)

Type locality: Tse-Kou, N Yunnan, China

Distribution: China (N Yunnan)

Note: This species is very local and only one worn specimen was collected at locality 9.

***Aulocera sybillina* Oberthür, 1890**

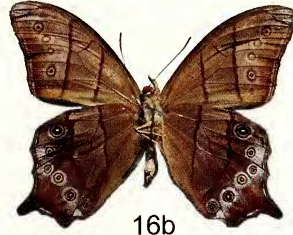
(Figs 21a, 21b)

Type locality: Kangding (Tatsienlu), Sichuan, China

Figs 16a–23. Satyrinae of Yunnan. **16a, 16b.** *Lethe kansa* (Moore), recto and verso, ♂, about 48 km north of Jinghong, Sanchahe Nat. Reserve, 760 m. **17a, 17b.** *Neope yama* (Moore), recto and verso, ♂, Xi Shan, Western Hills, 2200 m. **18a, 18b.** *Loxerebia sylvicola* (Oberthür), recto and verso, ♂, Lijiang City, Black Dragon Pool Park, 2400 m. **19a, 19b.** *Loxerebia sylvicola* (Oberthür), aberrant form, recto and verso, ♂, same locality as 18. **20a, 20b.** *Loxerebia ypthimoides* (Oberthür), recto and verso, ♂, same locality as 18. **21a, 21b.** *Aulocera sybillina* Oberthür, recto and verso, ♂, near Yulongxue Shan, Jade Dragon Snow Mountain, 3000 m. **22a, 22b.** *Ypthima phania* (Oberthür), recto and verso, ♂, same locality as 21. **23.** *Ypthima phania* (Oberthür), ♂, male genitalia, same locality as 21. Specimens shown at 75 % natural size.



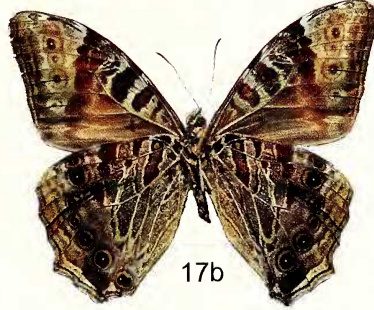
16a



16b



17a



17b



18a



18b



21a



19a



19b



21b



20a



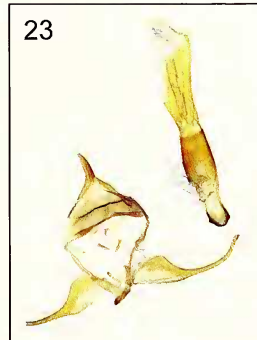
20b



22a



22b



23

Distribution: Tibet and W China. There are also unclear records from Sikkim, Yatung, and Garhwal (Gross, 1958)

Subspecies: *yunnanicus* Gross, 1958

Type locality: Likiang [Lijiang], 4000 m, Yunnan, China

Notes: Chou (1994) figures *sibyllina* without subspecific name while d'Abrera (1992) figures a male from Che tou. Huang (2001) mentioned no records at all. Our male specimen belongs to ssp. *yunnanicus* and was collected at locality 10, where it was flying in open spots in a pine forest.

Ypthima phania (Oberthür, 1891)

(Figs 22, 22a, 23)

Type locality: Yunnan, China

Distribution: China (Yunnan)

Notes: Shirozu & Shima (1979) treated *phania* as a species of the *sordida* group of *Ypthima* Hübner. They examined a male specimen from Likiang (Lijiang), collected on 7 July 1934 (coll. H. Höne) and determined by Forster (1948). And they agreed with this determination.

Huang (2001) only notes *phania* as belonging to the *motschulskyi*-group based on the analysis given by Shima (1988). Our specimens agree with the pictures given by Forster (1948) and those of Shirozu & Shima (1979). We found no illustrations of genitalia of *phania* in Forster, nor in Shirozu & Shima, or Huang (2001, 2003). We found our specimens at locality 10. We figure one male and its genitalia.

Altitudinal observations. In total we found 163 species of butterflies at localities 1–11 (see Appendix I). From low to high altitude the composition of the species changes gradually: species disappear and others come in. The distribution of the species from the lower to the higher altitudes is demonstrated on Fig. 24. In Appendix II these species are listed and it may be noted that some of them are recorded more than one time at different altitude classes, like *Zizina otis otis*, *Pseudozizeeria maha diluta*, *Parantica melaneus*, *Lobocla proximus*, and *Acraea issoria sordice*. Due to this 'double counting' the total number of species in the altitude classes of 2200–2400 m and 2600–3000 m differs from the numbers in Table 1.

The number of species per family-group taxon and their overlap over the altitude classes are demonstrated in Table 1.

Excluding the Acraeinae, with only one species, the Papilionidae, Riodininae, and Danainae particularly occupy a larger altitudinal range. At altitudes of 760 m and 2200–2400 m we found nearly the same numbers of species. In the latter altitude class, however, we spent more collecting days.

Many species (128) were found to be 'unique' to a particular altitude class. The number of unique species in each family-group taxon in relation to altitude is demonstrated in Table 2. Of these unique species 39.2% were found at the tropical locality 3. A relatively high percentage of the species (22.7%) were only observed between 2200–2400 m.

The number of species separated into family-group taxa in relation to the occupied altitude classes is demonstrated in Fig. 25. The Nymphalinae have an obvious peak

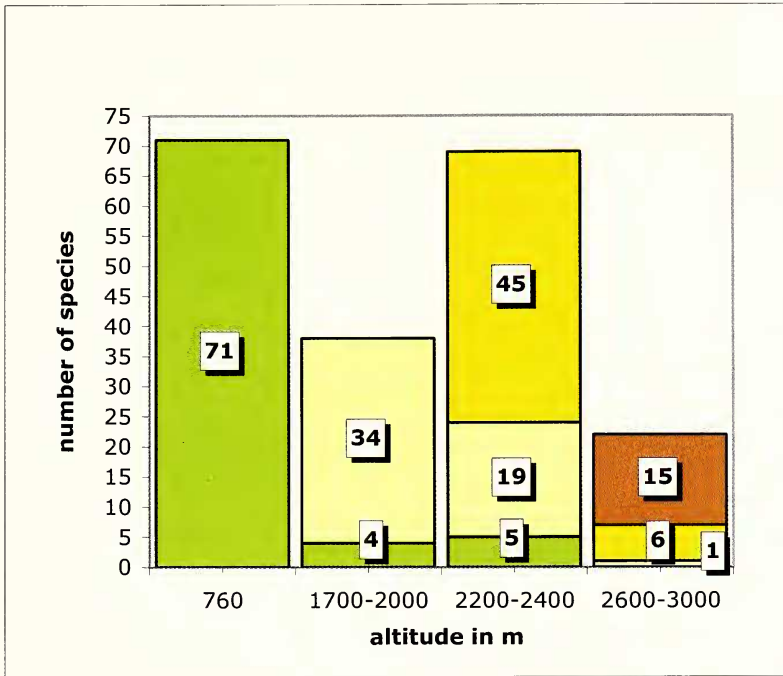


Fig. 24. Distribution of species in relation to altitude classes.

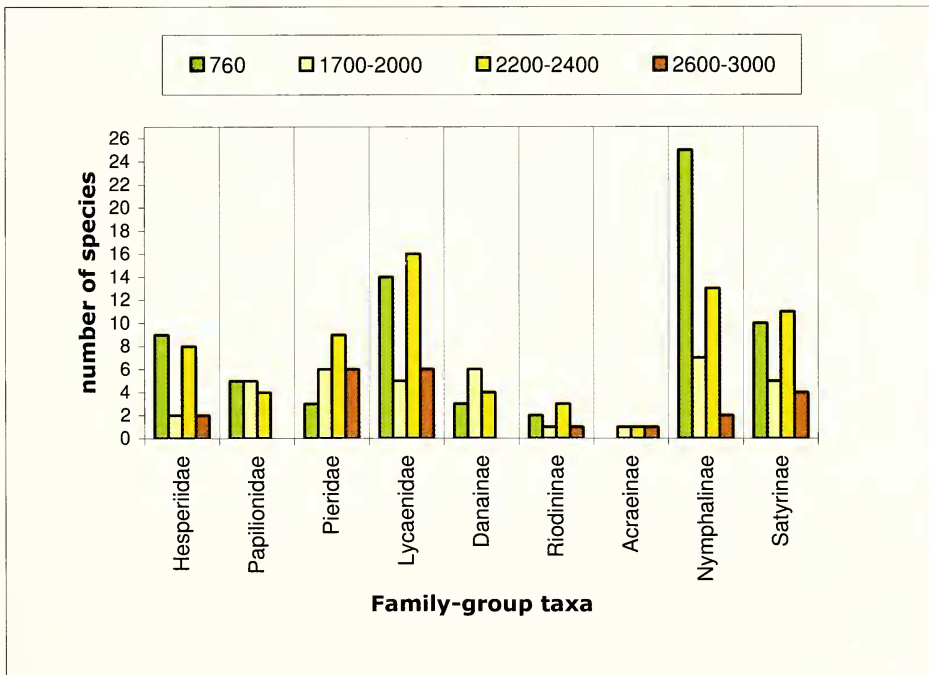


Fig. 25. Number of species by family-group taxon and altitude classes.

Tab. 1. Total number of species by altitude classes. Overlaps indicate the number of species observed in more than one altitude class. There is no percentage for Acraeinae because there is only one taxon.

altitude in m	760	1700–2000	2200–2400	2600–3000				
					<i>total</i>	<i>total spp. in group</i>	<i>overlap</i>	<i>% of species</i>
Hesperiidae	9	2	8	2	21	17	4	23.5
Papilionidae	5	5	4		14	10	4	40.0
Pieridae	3	6	9	6	24	20	4	25.0
Lycaeninae	14	5	16	6	41	32	9	28.1
Danainae	3	6	4		13	9	4	44.4
Riodininae	2	1	3	1	7	5	2	40.0
Acraeinae		1	1	1	3	1	2	–
Nymphalinae	25	7	13	2	47	44	3	6.8
Satyrinae	10	5	11	4	30	25	5	20.0
<i>Total</i>	71	38	69	22	200	163	37	22.7
<i>% species/altitude class</i>	43.6	23.0	42.3	13.5				

Tab. 2. Total number of species observed in only one altitude class, excluding Acraeinae.

altitude in m	760	1700–2000	2200–2400	2600–3000	<i>unique spp.</i>	<i>total spp. in group</i>	<i>% of species</i>
Hesperiidae	9	0	6	0	15	17	88.2
Papilionidae	4	1	1	0	6	10	60.0
Pieridae	2	2	5	6	15	20	75.0
Lycaeninae	11	2	8	3	24	32	75.0
Danainae	2	3	1	0	6	9	66.7
Riodininae	2	0	1	0	3	5	60.0
Acraeinae	0	0	0	0	0	1	0.0
Nymphalinae	25	4	10	2	41	44	93.2
Satyrinae	9	1	5	3	18	25	72.0
<i>Total</i>	64	13	37	14	128	163	78.5
<i>% of unique species/altitude class</i>	39.2	8.0	22.7	8.6	78.5		

at 760 m, but the Pieridae, Lycaeninae and Satyrinae were better represented between 2200–2400 m.

Tab. 3. Relative similarities of altitude classes with regard to the number of species. **Bold:** Number of species in altitude class; **Normal:** Taxa in common by altitude class; **Italic:** Similarity coefficient between two altitude classes.

altitude in m	760	1700–2000	2200–2400	2600–3000
760	71	4	5	0
1700–2000	<i>0.04</i>	38	19	1
2200–2400	<i>0.04</i>	<i>0.215</i>	69	6
2600–3000	<i>0</i>	<i>0.016</i>	<i>0.07</i>	22

Tab. 4. Numbers and percentage of Palaearctic species observed in relation to the total numbers of observed species.

	Total	Palaearctic	%
Hesperiidae	17	6	35.3
Papilionidae	10	9	90.0
Pieridae	20	18	90.0
Riodininae	5	4	80.0
Lycaeninae	32	16	50.0
Danainae	9	6	66.7
Acraeninae	1	1	100.0
Nymphalinae	44	20	45.5
Satyrinae	25	10	40.0
<i>Total species</i>	<i>163</i>	<i>90</i>	<i>55.2</i>
<i>Loc. 3 Palaearctic</i>	<i>-71</i>	<i>-30</i>	<i>42.2</i>
<i>Other locations</i>	<i>92</i>	<i>60</i>	<i>65.2</i>

Xishuangbanna (Locality 3). At this locality 71 species of butterflies and skippers were observed during 2.5 days of collecting only. This result suggests that the area is particularly rich in species. Thanks to the contribution of Huang & Xue (2004), who collected in late June and for the whole of July 2003 at three localities in Xishuangbanna, a list of 256 species is available. Along with other literature data in Lee (1962) and Wang & Fan (2002) 318 species have been reported from Xishuangbanna. Our contribution reflects only 22.3% of the known Rhopalocera fauna of the area, but nevertheless we can report several new species not mentioned in previous publications:

Papilionidae

- *Papilio protenor euprotenor* Frühstorfer, 1908
- *Atrophaneura latreillei genestieri* Oberthür, 1918

Nymphalinae

- *Athyma cama cama* Moore, 1858
- *Athyma kanwa phorkys* (Frühstorfer, 1912)

- *Athyma jina* Moore, 1857
- *Cheresonesia risa transiens* (Martin, 1903)
- *Polyura athamas athamas* (Drury, 1773)
- *Rohana parisatis staurakius* (Fruhstorfer, 1913)

Charaxinae

- *Charaxes aristogiton* C. & R. Felder, 1867

Satyrinae

- *Mycalesis mamerta mamerta* (Stoll, 1780)

Similarity (Tab. 3). The coefficients of similarity between the altitude classes are very low. The fauna within 1700–2000 m of elevation is most similar to that between 2200–2400 m, but this relation is not very convincing! The provisional conclusion is that more data are needed to suggest any similarity.

Biogeography. Throughout Central Asia the Palaearctic butterfly fauna interfaces with Oriental taxa. Sometimes the barrier is well defined, but mostly the boundaries are confusing. Boundaries vary from one locality to another due to geographical, climatic, ecological, and altitudinal factors. Bozano (1999) considers that in China, all species distributed north of latitude 34° N are Palaearctic. D’Abrera (1990) takes 30° N as a reference line. In transition areas like western and central China Palaearctic elements are accepted between 34° and 26° N (Bozano 1999). Yunnan belongs to such a transition area, where Palaearctic- and Oriental taxa fly together. Bozano (1999) points out that many genera found in this area do not have an obvious Palaearctic or Oriental identity (*Neope*, *Heliophorus*, *Callerebia*). An additional zoogeographical region, the Himalayan-Sino-Japanese region, was suggested by Palestini et al. in Bozano et al. (1999).

Though the fauna in South Yunnan is predominantly Oriental, its Palaearctic elements cannot be neglected. A taxon is treated here as being Palaearctic if it has been observed in the Palaearctic Region. In that sense 42.2% of the species that we found at locality 3 also have a limited Palaearctic distribution. Most of these species have an Oriental distribution and only “touch” the Palaearctic Region. Two species are mainly Oriental-Ethiopian (*E. hecabe*, *H. bolina*) and another three (*H. bolina*, *G. sarpedon*, *L. plinius*) are mainly Oriental, but are also distributed in Australia. *Hypolimnas bolina* is curiously also known from Saudi Arabia and Madagascar. Only two species (*C. argiolus*, *P. maha*) are predominantly Palaearctic although they also come into the Oriental Region. In Appendix III we list the species with a Palaearctic/ Oriental interface at locality 3. Besides locality 3 (22°10’ N) all other localities treated here are between the latitudes of 24°49’ N and 27°03’ N. In these localities 65.2% of the taxa are generally accepted as belonging to the Palaearctic fauna as well (Table 4). Finally, the Palaearctic species - in the sense mentioned above - are indicated with a P in Appendix I. It may be noted, that many species of the Papilionidae, Pieridae, and Riodininae are Palaearctic (with connection into the Oriental). This means that the latitudes taken as boundaries for 100% of the Palaearctic taxa treated by Bozano and d’Abrera, are very acceptable, but that even at lower latitudes Palaearctic taxa can be observed.

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Appendix I. Lepidoptera species observed in Yunnan, China from 16 June until 3 July 2006. 'P' refers to Palaearctic species. Continuation.

altitude in m	760	1700-2000	1700-2000	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2600-3000	2600-3000
localities	3	2	7	1	4	6	8	9	11	5	10		
Papilionidae													
<i>Graphium sarpedon</i> (Linnaeus, 1758)	3	0											
<i>Papilio bianor ganesa</i> Doubleday, 1842	4		0	0									
<i>Papilio paris</i> Linnaeus, 1758	5	0											
<i>Papilio polytes</i> Linnaeus, 1758	6	0											
<i>Papilio protenor euprotenor</i> Fruhstorfer, 1908	7	0	0										
<i>Papilio xuthus</i> Linnaeus, 1767	8	0	0	0	0	0	0	0					
<i>Papilio syfanius</i> Oberthür, 1890	9							0					
<i>Troides aeacus</i> (C. & R. Felder, 1860)	10	0											
number of species	5	4	1	2	1	1	1	1	1				
Pieridae (20 species)													
<i>Anthocharis bieti</i> (Oberthür, 1884)	1											0	
<i>Aporia bieti gregoryi</i> Watkins, 1927	2								0				
<i>Aporia larraldei nutans</i> (Oberther, 1892)	3										0		
<i>Aporia martinetti</i> (Oberthür, 1884)	4											0	
<i>Catopsilia pomona</i> (Fabricius, 1775)	5	0											
<i>Colias erate sinensis</i> Verity, 1911	6	0	0	0	0	0	0	0	0				
<i>Colias fieldi</i> Menetrier, 1855	7				0								
<i>Delias subnubila</i> Leech, 1893	8											0	
<i>Dercas lycorias</i> (Doubleday, 1842)	9			0	0								
<i>Eurema blanda silhetana</i> (Wallace, 1867)	10	0	0										
<i>Eurema brigitta rubella</i> (Wallace, 1867)	11	0	0										
<i>Eurema hecabe</i> (Linnaeus, 1758)	12	0	0	0	0	0	0	0	0				
<i>Eurema laeta sikkima</i> (Moore, 1906)	13	0	0	0	0	0	0	0	0				

Appendix I. Lepidoptera species observed in Yunnan, China from 16 June until 3 July 2006. 'P' refers to Palaearctic species. Continuation.

altitude in m		760	1700-2000	1700-2000	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2600-3000	2600-3000
localities		3	2	7	1	4	6	8	9	11	5	10
Nymphalinae												
<i>Athyna nefia asiata</i> Moore, 1858		5	0									
<i>Athyna kanwa phorkys</i> (Fruhstorfer, 1912)		6	0									
P <i>Boloria gong charis</i> (Oberthür, 1891)		7										0
P <i>Calinaga buphonas</i> Oberthür, 1920		8			0	0						
<i>Cethosia biblis</i> (Drury, 1773)		9	0									
<i>Cethosia cyane euanthes</i> Fruhstorfer, 1912		10	0									
<i>Charaxes bernardus hierax</i> (C. & R. Felder, 1867)		11	0									
<i>Charaxes aristogiton</i> Felder 1867		12	0									
<i>Chersonesia risa transites</i> (Martin, 1903)		13	0									
P <i>Childreana childreni</i> Gray, 1831		14			0							
<i>Cupha erymanthis</i> (Drury, 1773)		15	0									
<i>Doleschallia bisaltide continentalis</i> Fruhstorfer, 1899		16	0									
<i>Hypolimnas bolina jacintha</i> Drury, 1773		17	0									
<i>Junonia almana</i> (Linnaeus, 1758)		18	0									
P <i>Junonia iphita</i> (Cramer, 1779)		19	0									
P <i>Junonia lemonias</i> (Linnaeus, 1758)		20	0									
P <i>Junonia orithya</i> (Linnaeus, 1758)		21	0			0						
P <i>Kallima inachus chinensis</i> Swinhoe 1893		22		0								
P <i>Kaniska canace</i> Linnaeus, 1763		23				0						
<i>Lexias pardalis jadeitina</i> (Fruhstorfer, 1913)		24	0									
P <i>Limenitis homeyeri meridionalis</i> Hall, 1930		25				0						
P <i>Melitaea bellona</i> Leech, 1893		26										0
P <i>Melitaea yuenty</i> Oberthür, 1888		27							0			

Appendix I. Lepidoptera species observed in Yunnan, China from 16 June until 3 July 2006. 'P' refers to Palearctic species. Continuation.

altitude in m	760	1700-2000	1700-2000	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2200-2400	2600-3000	2600-3000
localities	3	2	7	1	4	6	8	9	11	5	10
number of species	10	5		4	6	3	0	3	1	2	2
summary											
Hesperiidae	9	1	1	2	8	3		3		1	1
Papilionidae	5	4	1	2	1	1	1	1			
Pieridae	3	6	1	2	7	4		1	3	2	4
Lycaeninae	14	4	3	1	10	7	2	3	5	2	4
Danaidae	3	3	4	1	3			1			
Riodininae	2	1		1	3				1	1	
Acraeinae		1		1	1	1				1	
Nymphalinae	25	6	1	4	10	1		3			2
Satyrinae	10	5		4	6	3		3	1	2	2
Totals	71	31	11	18	49	20	3	15	10	9	13

Appendices

Appendix II. Lepidoptera species observed in several altitude classes. See also Tab. I.

from 760 m into	2000	2400	3000
<i>Celastrina argiolus iyntema</i> (de Niceville, 1884)		X	
<i>Eurema hecabe</i> (Linnaeus, 1758)	X		
<i>Leptotes plinius</i> (Fabricius, 1793)		X	
<i>Neptis somia shania</i> Evans, 1924	X		
<i>Papilio protenor euprotenor</i> Fruhstorfer, 1908	X		
<i>Parantica melaneus</i> (Cramer, 1775)	X	X	
<i>Pseudozizeeria maha diluta</i> (Felder, 1865)	X	X	
<i>Ypthima baldus luoi</i> Huang, 1999		X	
Totals	5	5	0
from 2000 m into	2400	3000	
<i>Acraea issoria sordice</i> (Fruhstorfer, 1914)	X	X	
<i>Carterocephalus alcinoides</i> Lee, 1962		X	
<i>Colias erate sinensis</i> Verity, 1911		X	
<i>Dodona dirga</i> (Kollar & Redtenbach, 1844)		X	
<i>Euploea core anymone</i> (Godart, 1819)		X	
<i>Eurema brigitta rubella</i> (Wallace, 1867)		X	
<i>Eurema hecabe</i> (Linnaeus, 1758)		X	
<i>Eurema laeta sikkima</i> (Moore, 1906)		X	
<i>Everes lacturnus</i> (Godart, 1824)		X	
<i>Gonepteryx amintha murayamae</i> Nekrutenko, 1973		X	
<i>Graphium cloanthus</i> (Westwood, 1841)		X	
<i>Junonia orithya</i> (Linnaeus, 1758)		X	
<i>Lethe sidonis</i> (Hewitson, 1863)		X	
<i>Lobocla proximus</i> (Leech, 1891)		X	

Appendix II. Lepidoptera species observed in several altitude classes. See also Tab. 1. Continuation.

from 2000 m into	2400	3000
<i>Nepris hylas</i> Linnaeus, 1758	X	
<i>Papilio bianor ganesa</i> Doubleday, 1842	X	
<i>Papilio xuthus</i> Linnaeus, 1767	X	
<i>Parantica melaneus</i> (Cramer, 1775)	X	
<i>Pseudozizeeria maha diluta</i> (Felder, 1865)	X	
<i>Rapala nissa nissa</i> (Kollar, 1844)	X	
<i>Tirumala limniace</i> (Cramer, 1775)	X	
<i>Ypthima dromon</i> Oberthur, 1871	X	
<i>Ypthima ciris</i> Leech, 1891	X	
<i>Ypthima tiani nuae</i> Huang, 2001	X	
<i>Zizina otis</i> (Fabricius, 1787)	X	X
Totals	25	3
from 2400 m into		3000
<i>Acraea issoria sordice</i> (Fruhstorfer, 1914)		X
<i>Callerebia polyphemus suroia</i> Tytler, 1914		X
<i>Dodona dipoea</i> Hewitson, 1865		X
<i>Heliothorus eventa</i> Fruhstorfer, 1918		X
<i>Lobocla proximus</i> (Leech, 1891)		X
<i>Ochlodes subhyalina</i> (Bremer & Grey, 1853)		X
<i>Tongeia ion</i> (Leech, 1891)		X
<i>Zizina otis</i> (Fabricius, 1787)		X
Total		8

Appendices

Appendix III. Lepidoptera species observed at locality 3 with their distribution characteristics.

	mainly Palearctic	mainly Oriental	mainly Oriental- Ethiopian	mainly Oriental- Australian
<i>Atrophaneura latreillei genestieri</i> Oberthür, 1918		X		
<i>Celastrina argiolus</i> Linnaeus, 1758	X			
<i>Cethosia biblis</i> Drury, 1773		X		
<i>Charaxes bernardus hierax</i> C. & R. Felder, 1867)		X		
<i>Cupha erymanthis</i> (Drury, 1773)		X		
<i>Doleschallia bisaltide continentalis</i> Fruhstorfer, 1899		X		
<i>Euploea mulciber</i> (Cramer, 1777)		X		
<i>Eurema hecabe</i> (Linnaeus, 1758)			X	
<i>Graphium sarpedon</i> (Linnaeus, 1758)				X
<i>Hypolimnas bolina jacintha</i> Drury, 1773			X	X
<i>Junonia iphita</i> Cramer, 1779		X		
<i>Junonia lemonias</i> (Linnaeus, 1758)		X		
<i>Leptotes plinius</i> (Fabricius, 1793)				X
<i>Lethe confusa</i> Aurivillius, 1898		X		
<i>Lethe europa gada</i> Fruhstorfer, 1911		X		
<i>Melanitis leda</i> (Linnaeus, 1758)		X		
<i>Mycalesis mineus subfasciata</i> (Moore, 1882)		X		
<i>Papilio paris</i> (Linnaeus, 1758)		X		
<i>Papilio protenor euprotenor</i> Fruhstorfer, 1908		X		
<i>Parantica melaneus</i> (Cramer, 1775)		X		
<i>Polyura athamas</i> (Drury, 1773)		X		
<i>Pseudozizeeria maha diluta</i> (Felder, 1865)	X	X		
<i>Troides aeacus</i> (C. & R. Felder, 1860)		X		
<i>Ypthima baldus luoi</i> Huang, 1999		X		
<i>Zemeros flegyas</i> (Cramer, 1780)		X		
Totals	2	20	2	3